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Don Anderson

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1 Why FireWire?

This Chapter

This chapter provides a brief history of FireWire (IEEE 1394). It also discusses the need for FireWire and reviews the applications for which it is well suited.

The Next Chapter

The next chapter describes the primary features of the FireWire serial bus implementation. The chapter also reviews the IEEE 1394 standards (IEEE 1394-1995 & IEEE 1394.A) and IEEE ISO/IEC 13213 (ANSI/IEEE 1212) standard that the FireWire serial bus is based upon.

Overview

Development of FireWire began in the mid 1980s by Apple Computer. In fact, the term FireWire is a registered trademark of Apple Computer Corporation. As other manufacturers gained interest in FireWire, a working committee was formed to create a formal standard on the architecture. The resulting specification was submitted to IEEE and IEEE 1394-1995 was adopted.

Motivations Behind FireWire Development

FireWire provides a serial bus interconnect that allows a wide range of high performance devices to be attached. A variety of issues led to the development of FireWire. The primary characteristics of this serial bus include:

- Ease of use
- Low cost device implementations
- High speed application support
- Scalable performance
- Support for isochronous applications
- Huge amount of memory mapped address space supported (16 exabytes)
- Operation independent of host system

Inexpensive Alternate to Parallel Buses

The IEEE 1394 serial bus provides an alternative to more expensive parallel bus designs. Benefits of the serial bus over most parallel bus implementations are listed below.

- Reduced cost compared with many parallel bus implementations.
- Peripherals in current personal computer systems reside on a variety of buses (e.g. PCI and ISA buses). Communication between such devices can be problematic due to bus protocol and speed differences, thus slowing overall performance. FireWire provides an opportunity to locate a wide variety of peripheral devices that connect to the same serial bus, resulting in performance gains. Up to 63 nodes can be attached to a single serial bus.
- Many parallel buses are confined to a small physical area; however, serial bus has much greater flexibility (4.5 meters between devices).
- FireWire supports direct attachment of remote peripherals.
- The 1394 bus can be implemented in conjunction with the parallel bus to provide fault tolerance.

Plug and Play Support

Devices attached to the IEEE 1394 serial bus support automatic configuration. Unlike USB devices, each 1394 node that attaches to the bus automatically participates in the configuration process without intervention from the host system. Each time a new device is added to or removed from the bus, the 1394 bus is re-enumerated. This occurs whether or not the bus is attached to a host system.

Eliminate Host Processor/Memory Bottleneck

Like any bus that supports bus mastering, the 1394 bus has the ability to increase overall system performance. In a PC environment the 1394 bus can reduce traffic across PCI and reduce accesses to the memory subsystem. This can be accomplished by locating devices on the 1394 bus that communicate with each other frequently. This eliminates the need for the processor and memory subsystems to be involved in the transfer of data between devices.

High Speed Bus with Scalable Performance

Many peripheral devices such as hard drives and video cameras require high throughput. The 1394 bus accommodates these types of devices with a 400Mb/s transfer rate. This yields a theoretical throughput of 50MB/s in contrast to the throughput of ISA (8MB/s) and PCI (132MB/s). The 1394 serial bus provides scalable performance by supporting transfer rates of 400Mb/s, 200Mb/s, and 100Mb/s.

Support for Isochronous Applications

The serial bus supports isochronous transfers to support applications such as audio and video which require constant transfer rates. The isochronous transfer support reduces the amount of buffering required by isochronous applications, thereby reducing cost.

BackPlane and Cable Environments

1394 supports both a backplane and cable implementation, permitting flexibility of implementation. The backplane environment provides the ability of establishing a redundant serial bus communications channel in conjunction with a parallel bus implementation. The cable environment allows the remote attachment of peripheral devices with the possibility of supporting peripherals spread over a distance of greater than 250 meters. The capability makes the serial bus an attractive option for small network applications.

Bus Bridge

The huge amount of memory address space supported, high transfer rates, and low costs make the 1394 bus an attractive means of bridging between different host systems and between multiple serial bus implementations.

- Serial bus implementations can be used to bridge other buses together. The serial bus provides the ability to bridge between host systems of varying sizes and types, including PCs, mini-computers, and mainframes.
- A single serial bus supports 63 nodes but can supports up to 1024 serial buses, making the total number of nodes supported at nearly 64k.

1394 Applications

The scalable performance and support for both asynchronous and isochronous transfers makes FireWire an alternative for connecting a wide variety of peripherals including:

- Mass storage
- Video teleconferencing
- Video production
- Small networks
- High speed printers
- Entertainment equipment
- Set top box

IEEE 1394 Refinements

Early implementations based on different interpretations of the 1995 release of the specification resulted in some interoperability problems between different vendor parts. A supplement to the 1394-1995 specification is referred to as the 1394a supplement, and is designed to eliminate these problems. In addition to clarifying portions of the 1394-1995 specification, the 1394a supplement fixes problems, specifies enhancements that are designed to improve performance, and adds new functionality. This book covers the 1394a supplement (2.0 draft version) as it existed at the time of writing.

Power management support and a specification for designing 1394 bridges were also in development at the time of this writing. Portions of the preliminary Power Management specification are included in this text, while the state of the bridge specification was not mature enough to be included.

Yet another version of 1394 being developed is called the IEEE 1394.B specification. This specification defines even higher throughput including 800Mb/s, 1.6Gb/s, and 3.2Gb/s. This specification is being designed for backward compatibility to 1394-1995 and 1394a.